the immobility of the centre of gravity if we know that the direction of the motions of the insects is quite at random; but this is by no means required. The motion may be preferentially in a horizontal plane or along a determined line, say along the longer axis of the pond, provided only that the motions in any two opposite directions are equally frequent.

Not only that, even if the cloud, as a whole, is not immovable, we are not necessarily helpless. For, if the insect cloud and the photographer were both on a sailing vessel, circumstances would be the same as on the mainland, though now the cloud is in motion. Only, instead of the absolute displacement of the photographic apparatus, we must know the displacement relative to the ship, or rather *relative* to the *insect-cloud.* This, then, finally is the real thing wanted. We may obtain the distance of the insect-cloud, or, what comes to the same, the average distance of its members, as soon as we are able to find out the displacement of our point of view with regard to the centre of gravity of the cloud.

Our case is much the same in the world of the stars.

We shall be able to determine the average distance of the members of any arbitrary group of stars provided that we can find the motion of the solar system, both in amount and in direction, relative to the centre of gravity of the group.

Now, astronomical observations such as those which led the elder Herschel to his discovery of the solar motion through space enable us to determine the *direction* of the sun's motion relative to such groups as the stars of the third, fourth, &c., magnitude. Spectroscopy enables us to determine the *amount* of that motion.

We must be able, therefore, to find out the average distance of the stars in these groups. For other groups, such as the stars having an apparent centennial motion of 10″, 20″, &c., there is a difficulty. Still, however, we have succeeded in overcoming this difficulty by a somewhat indirect process, and pressing into service the stars of which the individual distances are known. This, then, is the upshot of astronomical work on the distances.

What we know about Star-distance.

By direct measurement we know the distance of some hundred individual stars.

For the rest we know the average distance of any fairly numerous group of stars of determinate apparent magnitude and apparent motion.[1]

The question is, Can this imperfect knowledge of the distances be considered as in any wise sufficient for obtaining an insight into the real arrangement of the stars in space? I think it can, and I will now try to show in what manner.

(*To be continued.*)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The following is the text of the speeches delivered by Prof. Love in presenting recipients of the degree of D.Sc. *honoris causa* at the Encænia on June 24:—

FULGENCE RAYMOND.

Antequam de huius viri laudibus loquar, breviter dixerim centum fere abhinc annos celeberrimam medicorum scholam Parisiis exstitisse, eandem sæculo proximo exeunte, Charcotio familiam ducente, maxima laude floruisse. Charcotio successit Fulgentius Raymond, magistro discipulus clarissimus: quo rem feliciter navante valetudinarium Salpetriense, in quo quasi in aliquo orbis terræ theatro partes primarias agit, omnium in se ora convertit. Hic excultæ sunt plurimæ rationes, quæ ex eo pendent quod hi præ se ferunt qui affirmant posse corpori ægrotantis ipsam mentem mederi: quo in genere hic noster, dum de cerebri et de medullæ spinalis natura docte luculenterque disserit, laudem maximam consecutus est. Felicissimum profecto amicitiæ inter Britanniam et Galliam reconciliatæ documentum duco, quod hic vir de medicorum apud Gallos insignissimorum usu et rationibus magno medicorum nostrorum conventu Londinii nuper contionatus est.

JETHRO JUSTINIAN HARRIS TEALL.

Descriptioni Geologicæ, impensis publicis faciendæ, quæ saxorum solo Britannico subiectorum naturam, qua vi conflata sint, quo tempore coorta exquirit, præfectus est Jethro Justinianus Harris Teall. Qui vir, quo melius rem tantam conficeret, non in uno tantum genere laudis excellit: neque enim solum rationes quæ latissime patent animo comprehendere, sed etiam minutissima quæque et observare et repræsentare miro modo potest. His artibus usus, cum saxorum diversissimorum compages scrutaretur, omnia e montibus vi ignea liquefactis exorta esse cognovit: idem mutationes quas hæc saxa patiuntur gravi pondere oppressa subtilissime enarravit. Quo ingenio, qua peritia in hoc genere usus sit declarat ille liber de Insularum Britannicarum Petrologia conscriptus, quem aureolum esse ego iure dixerim.

JAMES WARD.

Inter Psychologos nemo clarior est quam Jacobus Ward, qui Psychologiam, cuius scientiæ proprium sit singulorum sensus tractare, non ex alia scientia pendere sed sui iuris esse constanter asseverat: cuius in ore semper est vox illa "Ego sum. Nihil mihi hoc verius?" Qui vir ita priorum repertis usus est ut erroribus vitatis longius progrederetur: idem si quid boni usquam invenisset non aspernatus novam, quæ latissime pateret, rationem excogitavit et necessitudinem quandam inter mentem nostram et rerum naturam intercedere docuit. Psychologiam etiam cum aliis scientiæ generibus artissime cohærere monstravit et omnibus qui cognoscendi ratio quæ sit investigant vel hominum moribus student utilissimam esse contendit. Neque ei satis erat huic scientiæ novum quasi fundamentum præbere, sed multorum diverso in genere philosophorum opiniones reprehendit: quæ omnia in libro paucos abhinc annos edito pervulgata cum iis qui rerum naturæ investigandæ operam dant tum iis qui philosophiæ potissimum incumbunt maxime profuerunt.

MANCHESTER.—Lord Morley, Chancellor of the University, has nominated the following as recipients of honorary degrees on the occasion of his installation, which has been fixed for July 9:—the Right Hon. A. J. Balfour, Mr. E. J. Broadfield (treasurer of the University), Mr. Andrew Carnegie, Lord Courtney of Penwith, Lord Curzon of Kedleston, Sir Ed. Donner, Bart., Dr. A. M. Fairburn (principal of Mansfield College, Oxford), Sir Frank Forbes Adam (chairman of the university council), the Right Hon. R. B. Haldane, Sir H. F. Hibbert (chairman of the Lancashire Education Committee), Sir W. H. Houldsworth, Bart., Prof. Henry Jackson, Sir William Mather, Mr. J. Cosmo Melvill (donor to the Manchester Museum of the Cosmo-Melvill herbarium), and Sir Edward Maunde Thompson. In addition, the following honorary degrees will be conferred:—*LL.D.*, Mr. A. J. Evans (keeper of the Ashmolean Museum) and Mr. William Farrer (editor of the "Victoria County History of Lancashire"; *D.Sc.*, Emeritus Prof. Gamgee.

Mr. R. E. Slade has been elected to a Gartside travelling scholarship. Dr. Hans Geiger has been re-appointed to the Harling fellowship in physics.

THE Countess of Bective will present the prizes at the Horticultural College, Swanley, Kent, on Tuesday, July 14. Sir John Cockburn, K.C.M.G., will take the chair at 4 p.m.

WE are glad to be able to announce that a petition for a charter for a University of Bristol has been sent to the Privy Council. A concordat is being arrived at between University College, Bristol, and the Merchant Venturers' Society, which has for many years been identified with work of technical and secondary education in the city. The most liberal support for the University scheme has

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[1] At the present moment some objection might certainly still be made against the generality of this statement. In fact, the scarcity of spectroscopic data is the cause that, though the determination of the solar motion separately for such groups as the stars of determinate magnitude and proper motion is quite possible, it has not yet been carried through. As a consequence, the results used in what follows still rest on the assumption that the centres of gravity of all the groups considered are at rest relative to each other. That this assumption must be probably true follows from the near identity of the *direction* of the sun's motions, furnished by the several groups.

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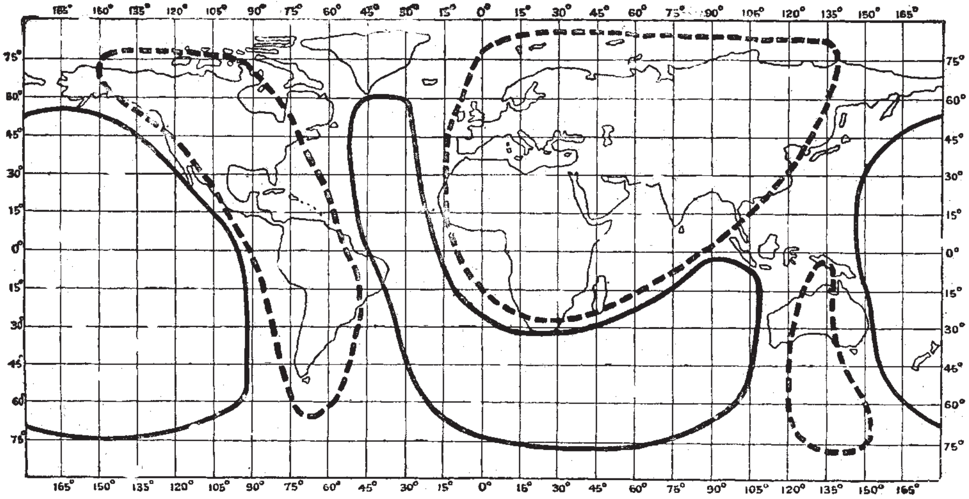
come from various members of the Wills family, no less a sum than 135,000*l.* having been promised toward its realisation by them. Of this amount, Mr. H. O. Wills has promised 100,000*l.*, Lord Winterstoke (formerly Sir W. H. Wills) 20,000*l.*, and Sir Frederick Wills 10,000*l.* More money is, however, still required to establish the University in a satisfactory manner; and it is to be hoped that other merchant princes of Bristol will follow the magnificent example which the Wills family has given them.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 30.—"Note on the Representation of the Earth's Surface by Means of Spherical Harmonics of the First Three Degrees." By Prof. A. E. H. **Love,** F.R.S.

In a previous paper the author had concluded from dynamical considerations that those elevations and depressions on the surface of the globe which correspond with continents and oceans should be capable of being represented, in respect of their main features, by means of spherical harmonics of the first, second, and third degrees. A rough spherical harmonic analysis of the actual elevations and depressions yielded a rather imperfect representation of the surface, which nevertheless offered a general resemblance to the actual distribution of land and water. It had, however, certain definite defects. To alter the computed figure it is necessary to change appropriately the coefficients of the spherical harmonic expression by which it is proposed to represent the elevation of the surface above the mean level. In the present paper there is recorded the best of many sets of trial coefficients, and the result is shown on the accompanying chart. In this chart the fine continuous line is a rough outline of the actual land of the globe, drawn in such a way that all degrees of latitude or of longitude have the same value on the map; the heavy line is the zero line of the surface harmonic with the chosen coefficients; the dotted line is the contour line along which the computed elevation is equal to one-tenth of its maximum value.



"The Relation between the Crystalline Form and the Chemical Constitution of the Picryl Derivatives." By G. **Jerusalem** and Prof. W. J. **Pope,** F.R.S.

By a method which depends upon dividing up the space occupied by a crystalline substance into polyhedral cells, each of which is assumed to be the habitat of but one atom, Barlow and Pope have been able to determine the general relation which exists between crystalline form and chemical constitution. They conclude that the polyhedral cells, each of which represents the domain of one atom and which fit together without interstices to form the crystal structure, possess volumes which are approximately proportional in magnitude to the lowest valencies exhibited by the elements which they respectively contain. The assemblages obtained by packing together the atomic domains mentioned are partitionable into identical units, each of which represents in composition, constitution, and configuration a chemical molecule of the substance concerned. The relation between the crystalline form and chemical constitution of a series of substances is conveniently illustrated by comparing the dimensions of polyhedra, of which the volumes are represented by the sum, W, of the valencies of the atoms composing the molecules, and of which the relative dimensions are the crystallographic axial ratios $a:b:c$. The dimensions referred to are termed the equivalence parameters $x:y:z$, and are calculated from the relations that $a:b:c=x:y:z$ and $xyz=\mathrm{W}$.

In the present paper the above considerations are applied to a number of derivatives of picric acid and allied substances; it is shown that in this series one of the three equivalence parameters remains approximately constant, and has about the value of z in the equivalence parameters of crystalline benzene, namely, $x:y:z=3{\cdot}101:3{\cdot}480:2{\cdot}780$. The direction in which the dimension z is measured in benzene is that in which columns formed by superposing triangularly arranged groups of three polyhedra, each occupied by a carbon atom, occur throughout the assemblage representing crystallised benzene. It is concluded that the crystal structures of the picryl derivatives are derived from that of benzene by moving the columns of carbon domains apart and packing the substituting groups in between them in accordance with the method already described by Barlow and Pope.

"On the Hysteresis Loss and other Properties of Iron Alloys under very Small Magnetic Forces." By Prof. Ernest **Wilson,** V. H. **Winson,** and G. F. **O'Dell.** Communicated by Sir William H. Preece, K.C.B., F.R.S.

The experiments were carried out on two alloys of iron, namely, "stalloy," of which the distinguishing feature is that it contains about 3 per cent. of silicon, and "lohys," which is a good sample of transformer plate. The principal object of the research is to find the magnetic properties of these materials under small magnetising forces, especially as regards hysteresis loss. Information is also given on the specific resistance and temperature coefficients of the materials.

For the magnetic tests the specimens are in the form of rings composed of stampings, and the ballistic galvanometer method has been employed.

Lord Rayleigh found by the magnetometer method that in the case of Swedish iron the permeability was nearly constant when the magnetic force (H) varied from 0·00004 to 0·04. In the present experiments the permeability also tends to become constant, the limiting values being 260 for stalloy and 222 for lohys. As regards the maximum value of the permeability, the results obtained have been compared with published figures for a very pure iron and a good sample of plate rolled from Swedish iron. For these materials the maximum permeabilities are respectively 5480 and 4450, and occur for values of the magnetic induction (B) of 9100 and 7000 respectively. For stalloy and lohys the maximum permeabilities are 4520 and 3280, and occur for values of B of 5000 and 5500 respectively.

As regards hysteresis loss, the following figures are

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